Micrium

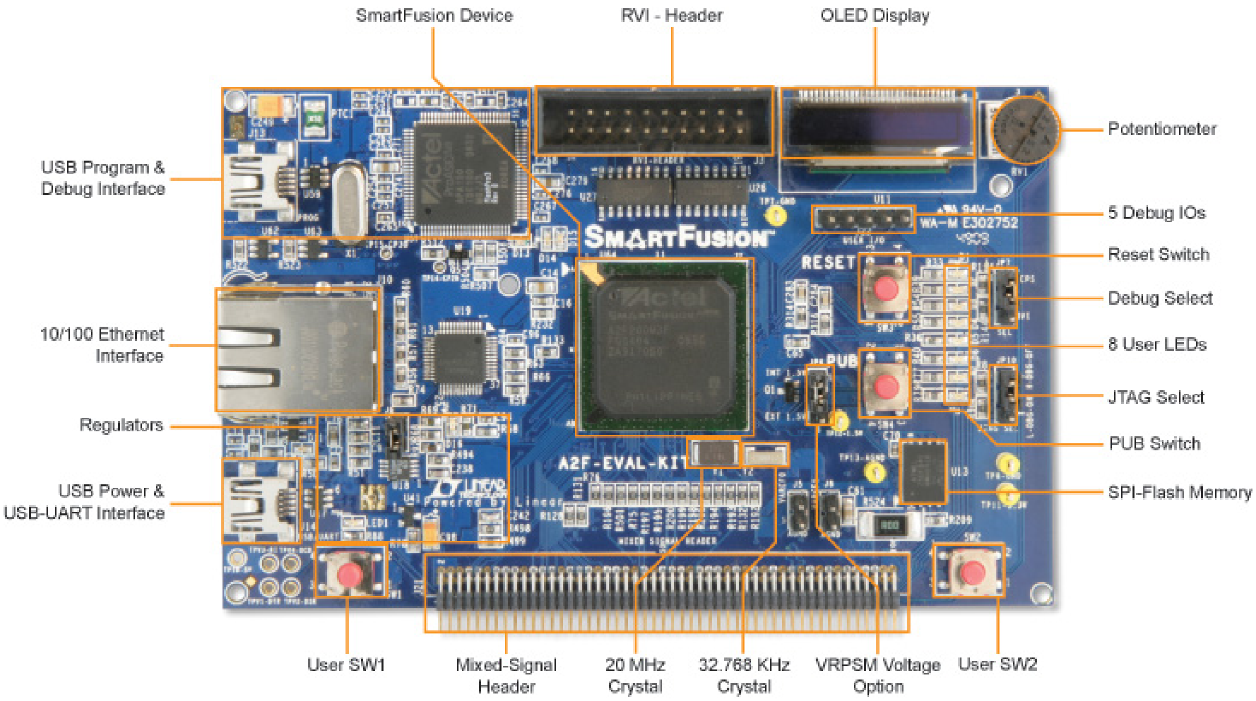
RTOS and Tools

Quick Start: µC/OS-III on the Actel SmartFusion Evaluation Kit (with SoftConsole)

This document describes how to build and run µC/OS-III example projects for Actel's SmartFusion Evaluation Kit. The projects covered in the document were developed with Actel's free Eclipse-based IDE, SoftConsole. The projects are intended to provide developers who are interested in using µC/OS-III with a convenient means of evaluating the software.

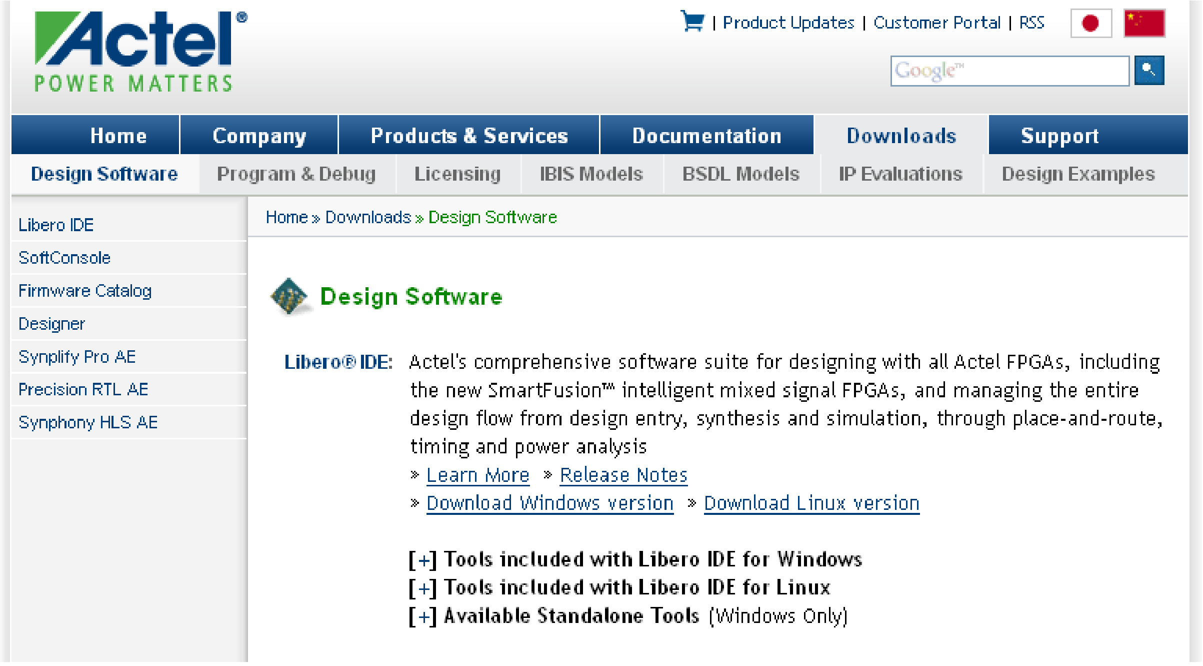
Required Hardware

Actel's SmartFusion Evaluation Kit is needed in order to run each of the projects described herein. The board included in this kit is shown below. With its Ethernet connector, OLED display, and Flash memory, the small, USB-powered board is ideal for developers who are looking to become acquainted with Actel's highly capable SmartFusion FPGAs.



Required Software and Tools

The SoftConsole IDE from Actel is needed to build and run the example projects that this document covers. Another tool from Actel, FlashPro, is required to download the bitstream associated with the projects. Both SoftConsole and FlashPro can be downloaded as part of Actel's Libero IDE by anyone who has registered on the Actel Web site. Libero is available from the following page on this site: http://www.actel.com/download/software/libero/default.aspx



Design Software

Libero® IDE: Actel's comprehensive software suite for designing with all Actel FPGAs, including the new SmartFusion™ intelligent mixed signal FPGAs, and managing the entire design flow from design entry, synthesis and simulation, through place-and-route, timing and power analysis

» Learn More » Release Notes
» Download Windows version » Download Linux version

[+] Tools included with Libero IDE for Windows
[+] Tools included with Libero IDE for Linux
[+] Available Standalone Tools (Windows Only)

Developers seeking to use Libero must have a license for the software. Free Gold 1-year licenses can be requested on the Actel Web site. These licenses provide access to all of the features that are needed to run Micriμm's μC/OS-III example projects.

Micriμm's Web site provides access to the μC/OS-III example projects and to μC/Probe, a unique visualization tool that one of the projects is intended to demonstrate. Visitors to the site must complete a registration form in order to download any of this software. (Unfortunately, developers who have registered on Actel's site must re-register on Micriμm's.) The URL for the example projects is http://micrium.com/page/downloads/ports/actel

There are actually two different versions of µC/Probe available from the URL listed on the previous page. One of the versions is full-featured but limits developers to a 30-day evaluation period. The other version has no time limit but does not facilitate monitoring more than 5 symbols. Either version is appropriate for the µC/OS-III example projects. (Developers should not download both.)

Software Versions

The example projects currently available on the Micriµm Web site were tested using Libero v9.0 and Service Pack C. Micriµm's engineers will attempt to keep the projects up-to-date, so that the software is always compatible with the newest version of Libero. It is possible, though, that the engineers may not be able to provide updated code for every tool release. Vistors to the Web site who are unable to build and run the projects using the latest version of Libero should contact Micriµm; relevant phone numbers and e-mail addresses are provided at the close of this document.

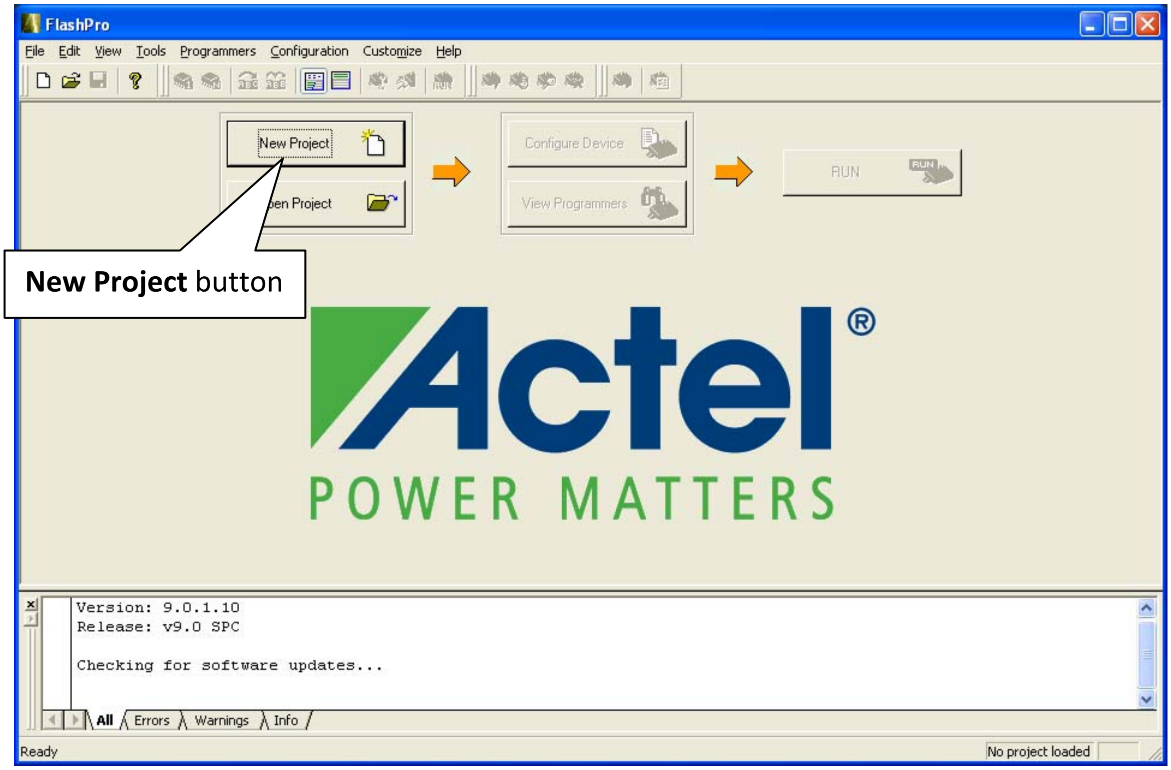
Downloading the Bitstream for the Examples

1. Before attempting to take any of the steps outlined below, you will need to install the software and tools described in the previous sections. In the case of *uCOS-III-Actel-SmartFusionEvalKit.zip* (the zip file containing the µC/OS-III example projects), "installing" simply means extracting the contents of the zip file. You can place the contents of the zip file practically anywhere on your PC.

2. Your board will need to be linked to your PC in order for you to be able to download the bitstream. After making sure that the **JP7** jumper is in the **USB PROG** position and that the **JP10** jumper is in the **FPGA** position, you should connect both of the board's USB connectors (labeled **J13** and **J14**) to unused ports on your PC. You'll likely receive multiple prompts to install drivers for the board. Assuming that you've installed the aforementioned software, Windows should be able to automatically locate the drivers.

3. You'll use FlashPro to download the bitstream. You should start this tool now, by selecting **All Programs>Actel Libero IDE v9.0>FlashPro v9.0>FlashPro v9.0** from your PC's **Start** menu.

4. After FlashPro has finished checking for updates, you should click the **New Project** button, which is shown in the screenshot on the next page. In the dialog box that subsequently appears on your screen, you should select **Single device**. You must then name your project and give it a location. You can use practically any combination of name and location.

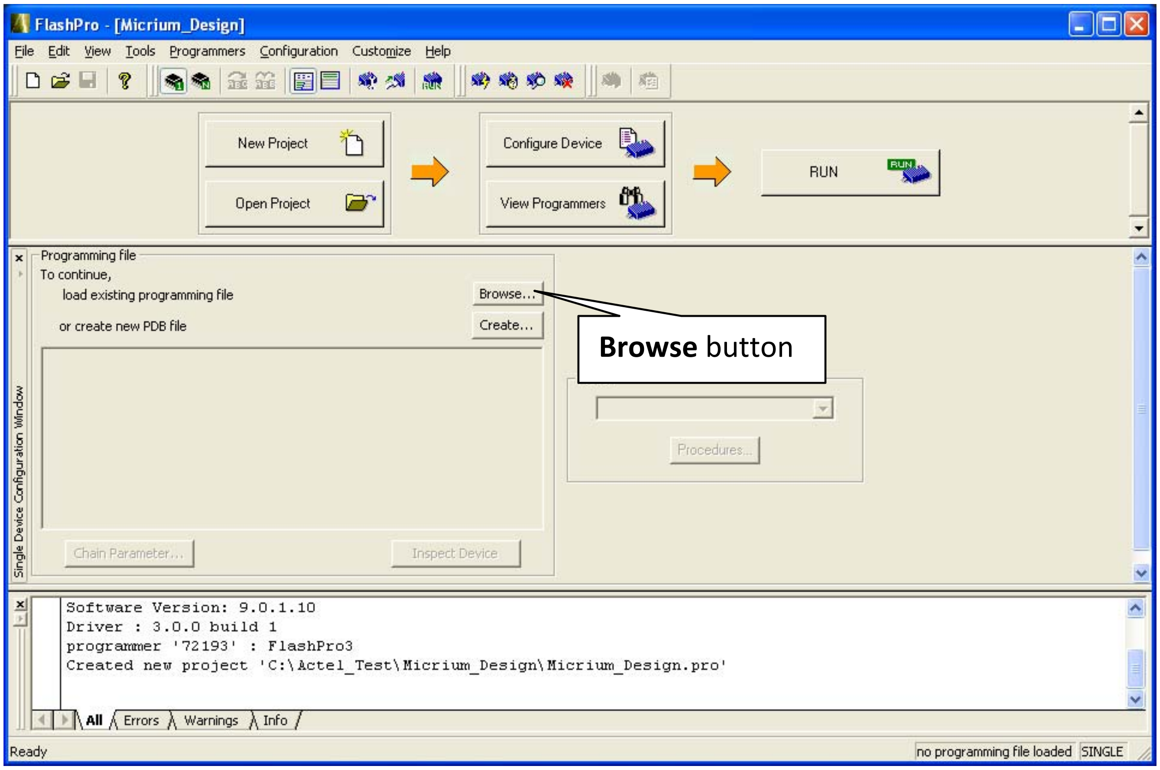


```
Version: 9.0.1.10
Release: v9.0 SPC

Checking for software updates...
```

New Project button

5. You should now click the large **Configure Device** button at the top of the screen. **In the Single Device Configuration Window** that next appears on your screen, you should click the **Browse** button, as indicated in the screenshot on the following page. You should then browse to the location of the example project's PDB file. The path of this file is given below. (*<Install folder>* is the folder to which you extracted the contents of *uCOS-III-Actel-SmartFusionEvalKit.zip*.)

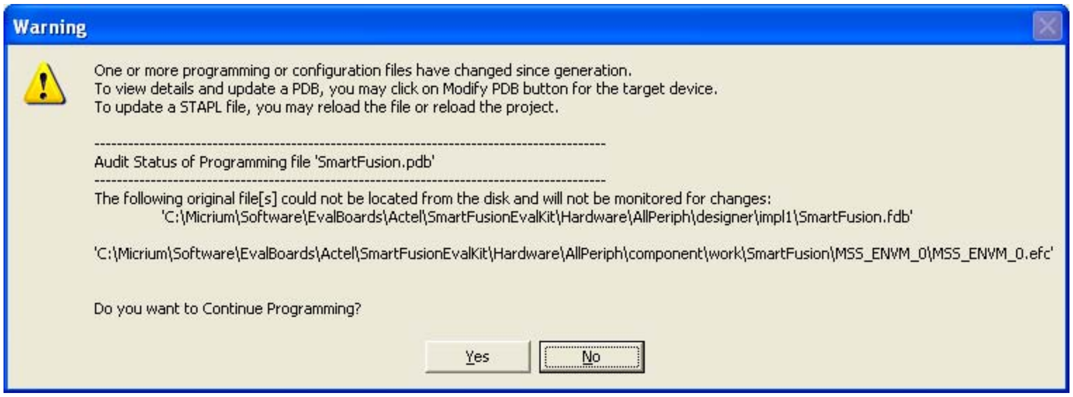
   <Install folder>\MICRIUM\Software\EvalBoards\Actel\SmartFusionEvalKit\Hardware\SmartFusion.pdb



```
Software Version: 9.0.1.10
Driver : 3.0.0 build 1
programmer '72193' : FlashPro3
Created new project 'C:\Actel_Test\Micrium_Design\Micrium_Design.pro'
```

6. FlashPro should now warn you that “One or more programming or configuration files have changed since generation.” You can ignore this warning.

7. To actually download the bitstream, you must click the large **PROGRAM** button located at the top of your screen. FlashPro will once again warn you about the modified programming file, this time via the dialog box shown below. You can click this box’s **Yes** button.



One or more programming or configuration files have changed since generation.
To view details and update a PDB, you may click on Modify PDB button for the target device.
To update a STAPL file, you may reload the file or reload the project.

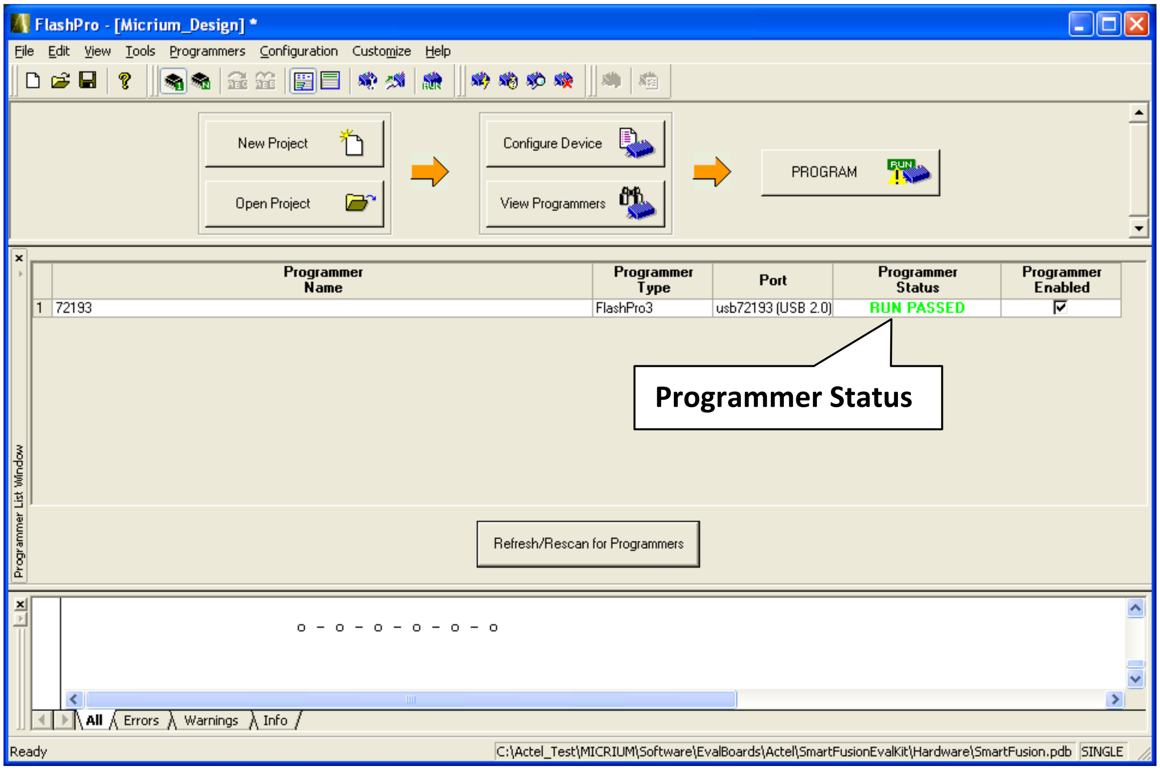
Audit Status of Programming file 'SmartFusion.pdb'

The following original file[s] could not be located from the disk and will not be monitored for changes:
'C:\Micrium\Software\EvalBoards\Actel\SmartFusionEvalKit\Hardware\AllPeriph\designer\impl1\SmartFusion.fdb'

'C:\Micrium\Software\EvalBoards\Actel\SmartFusionEvalKit\Hardware\AllPeriph\component\work\SmartFusion\MSS_ENVM_0\MSS_ENVM_0.efc'

Do you want to Continue Programming?

8. When the downloading process has completed, you should see **RUN PASSED** in the **Programmer Status** field of the **Programmer List Window**, as shown below. After receiving this indication of successful completion, you can close FlashPro. You won't need to use this tool anymore in order to run the µC/OS-III example projects. Nonetheless, you should probably save your project when FlashPro prompts you to do so.


FlashPro - [Micrium_Design] *
File Edit View Tools Programmers Configuration Customize Help
New Project
Open Project
Configure Device
View Programmers
PROGRAM
Programmer List Window
Refresh/Rescan for Programmers
All Errors Warnings Info

	Programmer Name	Programmer Type	Port	Programmer Status	Programmer Enabled
1	72193	FlashPro3	usb72193 (USB 2.0)	RUN PASSED	☑

Programmer Status

o – o – o – o – o – o

Ready C:\Actel_Test\MICRIUM\Software\EvalBoards\Actel\SmartFusionEvalKit\Hardware\SmartFusion.pdb SINGLE

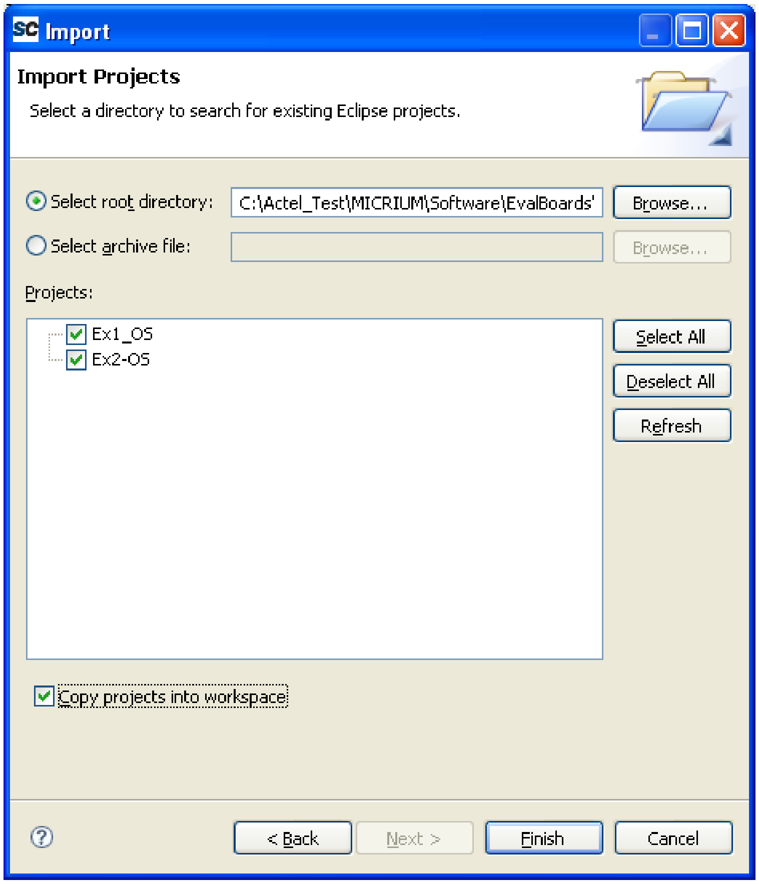
Building and Running Example 1

1. In order to run the µC/OS-III example projects, you'll need to change the position of the board's **JP10** jumper. You should now move this jumper to the **M3** position.

2. With your board connected to your PC via both USB connectors (**J13** and **J14**) you should now start SoftConsole by selecting **All Programs>Actel SoftConsole v3.1>Actel SoftConsole IDE** from your PC's **Start** menu.

3. If you have not previously used SoftConsole, you'll be prompted to select a workspace location. The ideal workspace location is the folder containing the example projects: *<Install folder>\MICRIUM\Software\EvalBoards\Actel\SmartFusionEvalKit\Software\SoftConsole*, where *<Install folder>* is the folder to which you extracted the contents of *uCOS-III-Actel-SmartFusionEvalKit.zip*. However, if you would prefer to use another folder (perhaps because you've already established a workspace in SoftConsole), you'll still be able to run the examples.

4. If you are not using the Workspace location provided above, you'll need to import the µC/OS-III projects. You can do so by selecting **Import** from SoftConsole's **File** menu. In the resulting dialog box, you should select **Existing Projects into Workspace** from the **General** category. You should then click the **Next** button. In the subsequent dialog box, which is shown below, you should first click **Select root directory** and then browse to the folder listed in step 3. You should then check **Ex1_OS** and **Ex2-OS**, as well as **Copy projects into workspace**, before clicking the **Finish** button.



Import

Import Projects

Select a directory to search for existing Eclipse projects.

● Select root directory: C:\Actel_Test\MICRIUM\Software\EvalBoards'

○ Select archive file:

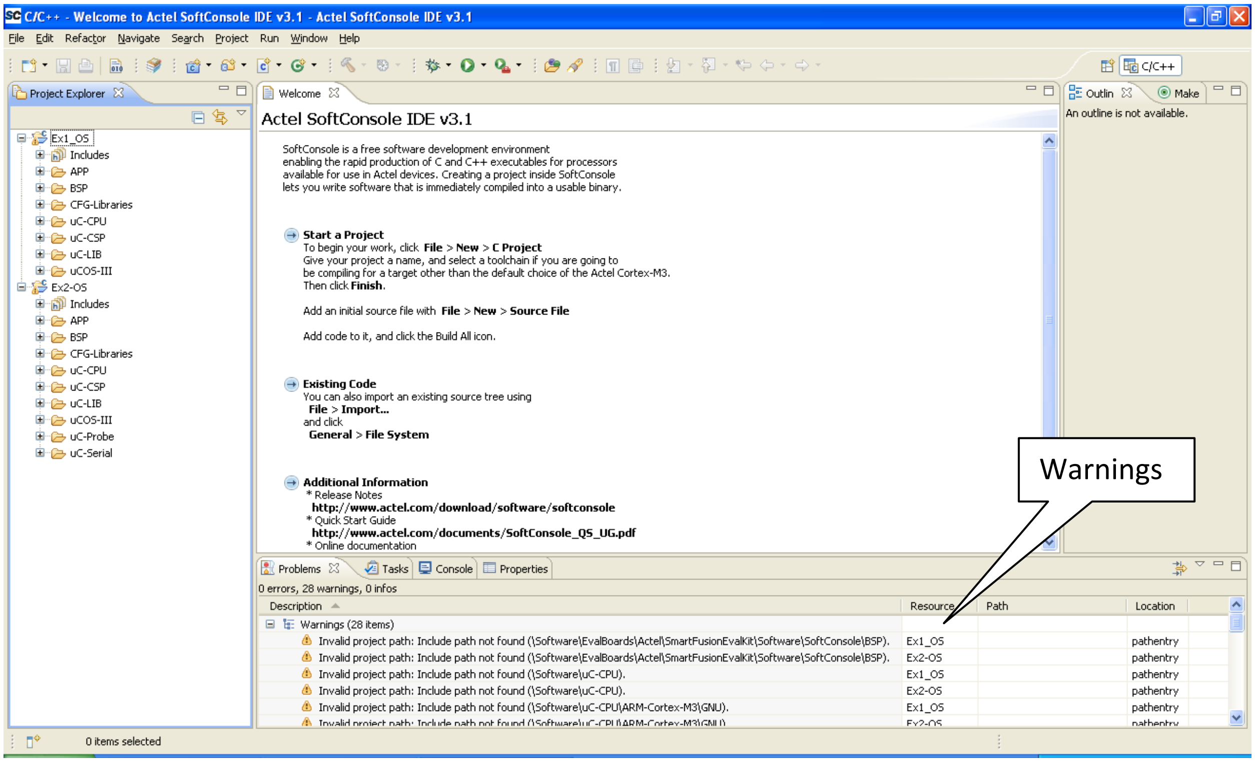
Projects:

☑ Ex1_OS

☑ Ex2-OS

☑ Copy projects into workspace

5. Regardless of your workspace location, you should now see **Ex1_OS** and **Ex2-OS** listed in SoftConsole's **Project Explorer**. You may also see several warnings listed in the **Problems** tab, as indicated below. These warnings indicate that SoftConsole was unable to locate the files comprising the two examples. You'll need to set a couple of variables in order to eliminate the warnings.



Actel SoftConsole IDE v3.1

SoftConsole is a free software development environment
enabling the rapid production of C and C++ executables for processors
available for use in Actel devices. Creating a project inside SoftConsole
lets you write software that is immediately compiled into a usable binary.

Start a Project
To begin your work, click **File** > **New** > **C Project**
Give your project a name, and select a toolchain if you are going to
be compiling for a target other than the default choice of the Actel Cortex-M3.
Then click **Finish**.

Add an initial source file with **File** > **New** > **Source File**

Add code to it, and click the Build All icon.

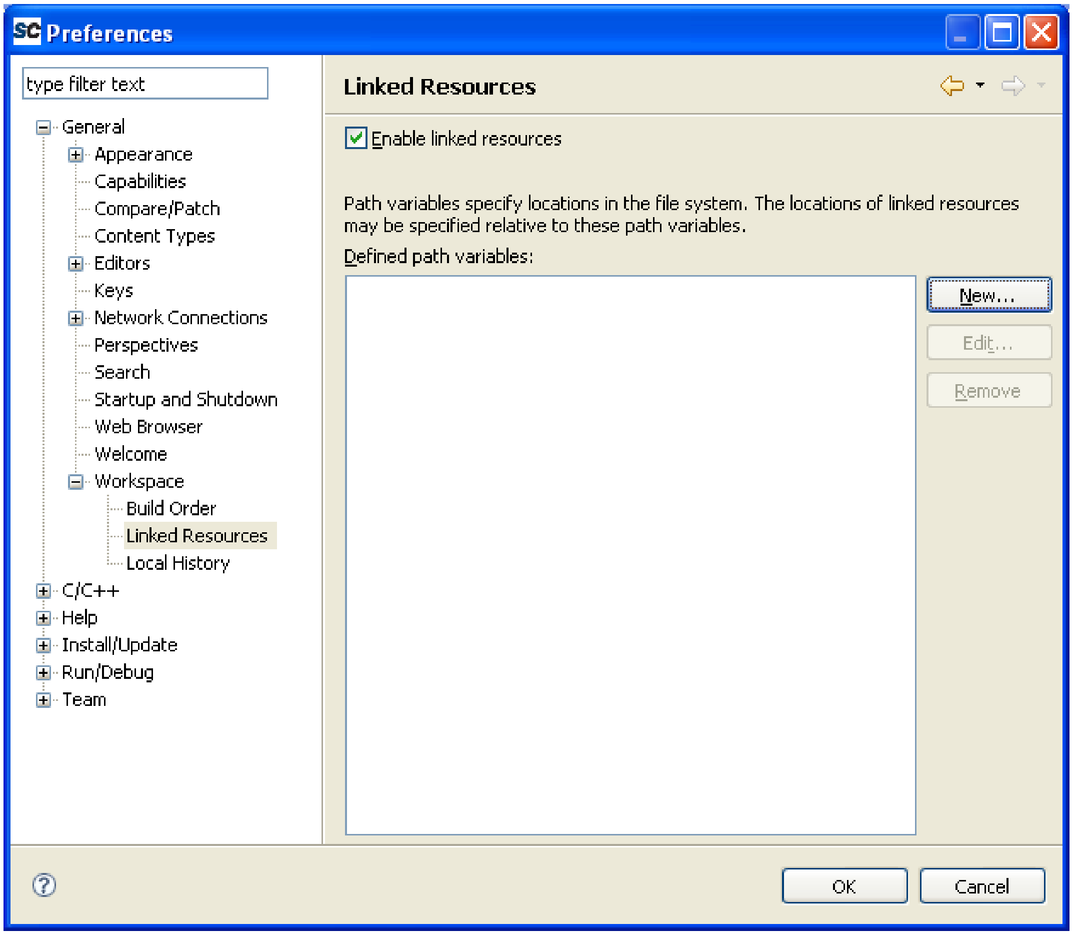
Existing Code
You can also import an existing source tree using
File > **Import...**
and click
General > **File System**

Additional Information
* Release Notes
http://www.actel.com/download/software/softconsole
* Quick Start Guide
http://www.actel.com/documents/SoftConsole_QS_UG.pdf
* Online documentation

0 errors, 28 warnings, 0 infos

Description	Resource	Path	Location
Warnings (28 items)			
Invalid project path: Include path not found (\Software\EvalBoards\Actel\SmartFusionEvalKit\Software\SoftConsole\BSP).	Ex1_OS		pathentry
Invalid project path: Include path not found (\Software\EvalBoards\Actel\SmartFusionEvalKit\Software\SoftConsole\BSP).	Ex2-OS		pathentry
Invalid project path: Include path not found (\Software\uC-CPU).	Ex1_OS		pathentry
Invalid project path: Include path not found (\Software\uC-CPU).	Ex2-OS		pathentry
Invalid project path: Include path not found (\Software\uC-CPU\ARM-Cortex-M3\GNU).	Ex1_OS		pathentry
Invalid project path: Include path not found (\Software\uC-CPU\ARM-Cortex-M3\GNU).	Ex2-OS		pathentry

6. To set the first of the two aforementioned variables, you'll need to open the SoftConsole **Window** menu and select **Preferences**. In the ensuing dialog box, you should expand the **General** category, followed by the **Workspace** category. You should then select **Linked Resources**, as shown in the screenshot on the next page.



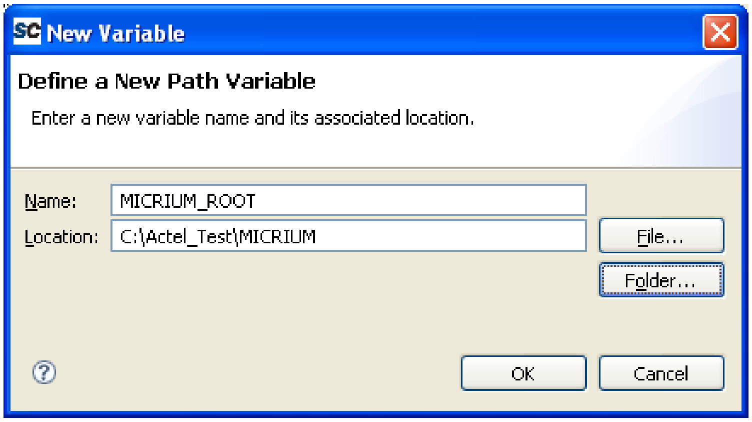
Linked Resources

☑ Enable linked resources

Path variables specify locations in the file system. The locations of linked resources may be specified relative to these path variables.

Defined path variables:

7. You should now click the **New** button on the **Linked Resources** page. You should name your new variable `MICRIUM_ROOT`, and you should assign it a value indicating the location of the *MICRIUM* folder that should have been created when you extracted the contents of *uCOS-III-Actel-SmartFusionEvalKit.zip*. For example, if your *MICRIUM* folder is located at *C:\Actel_Test\MICRIUM*, you should define `MICRIUM_ROOT` as shown in the screenshot on the next page.



New Variable

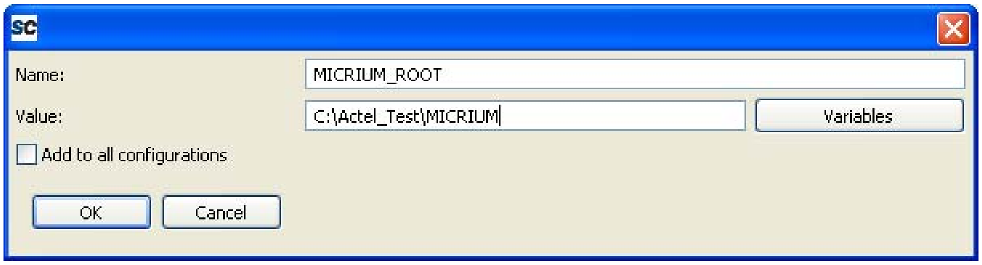
Define a New Path Variable

Enter a new variable name and its associated location.

Name: MICRIUM_ROOT

Location: C:\Actel_Test\MICRIUM

8. After defining MICRIUM_ROOT as a path variable, you'll need to define an environment variable, also named MICRIUM_ROOT. To do so, you must right click on **Ex1_OS** in the **Project Explorer** and select **Properties** from the resulting menu. In the dialog box that then appears, you should expand **C/C++ Build** (which you'll find in the menu on the left-hand side of the box) and then select **Environment**. Next, you should click the **New** button and define MICRIUM_ROOT. You must assign this environment variable the same value that you used to define the identically named path variable. An example is provided below.



Name: MICRIUM_ROOT

Value: C:\Actel_Test\MICRIUM

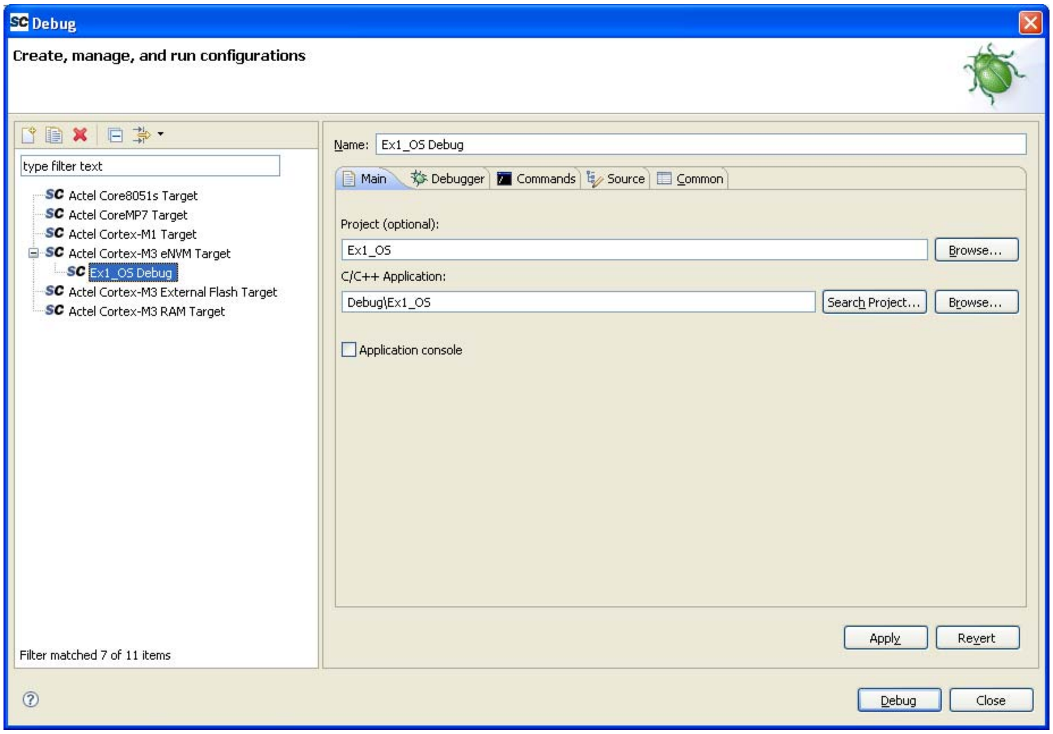
□ Add to all configurations

9. Before attempting to build the first project, you should repeat the above procedure for the second project. In other words, you should right-click **Ex2-OS** and then use the **Properties** dialog box to define MICRIUM_ROOT.

10. There should now be zero warnings in the **Problems** tab. Thus, you will be able to easily see any errors or warnings that appear during the build process. Before attempting to initiate this process, you should make sure that the first example's **Debug** configuration is active. You can determine which configuration is active by right-clicking **Ex1_OS** in the **Project Explorer** and selecting **Build Configurations**, followed by **Set Active**. You should make sure that a check mark appears beside **Debug**.

11. To build the example, you should right-click on **Ex1_OS** in the **Project Explorer** and select **Build Project** from the resulting menu. A **Build Project** dialog box will appear to indicate the status of the build operations. After SoftConsole has finished building the project, you should still have an empty **Problems** tab.

12. If you were able to build the project without any warnings or errors, you should now attempt to run the code. With **Ex1_OS** selected in the **Project Explorer**, you should select **Open Debug Dialog** from SoftConsole's **Run** menu. On the left-hand side of the **Debug Dialog** box that then appears, you'll find a list of multiple different targets. You should right-click **Actel Cortex-M3 eNVM Target** and select **New**. A configuration named **Ex1_OS Debug** should then appear under **Actel Cortex-M3 eNVM Target**. You should click on **Ex1_OS Debug** and make sure that this configuration's **Main** and **Commands** tabs look similar to those shown in the following screenshots. To start the debugger, you must click the **Apply** button and then the **Debug** button.



type filter text

- Actel Core8051s Target
- Actel CoreMP7 Target
- Actel Cortex-M1 Target
- Actel Cortex-M3 eNVM Target
  - Ex1_OS Debug
- Actel Cortex-M3 External Flash Target
- Actel Cortex-M3 RAM Target

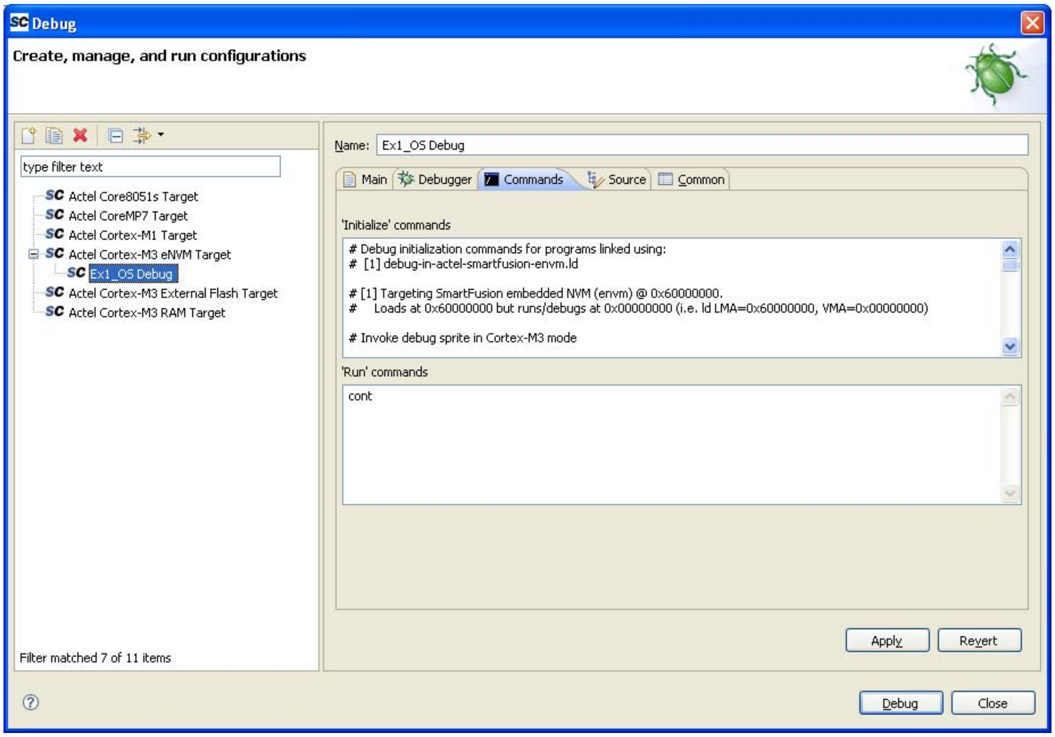
Filter matched 7 of 11 items

Name: Ex1_OS Debug

Project (optional): Ex1_OS

C/C++ Application: Debug\Ex1_OS

☐ Application console



type filter text

- Actel Core8051s Target
- Actel CoreMP7 Target
- Actel Cortex-M1 Target
- Actel Cortex-M3 eNVM Target
  - Ex1_OS Debug
- Actel Cortex-M3 External Flash Target
- Actel Cortex-M3 RAM Target

Filter matched 7 of 11 items

Name: Ex1_OS Debug

'Initialize' commands

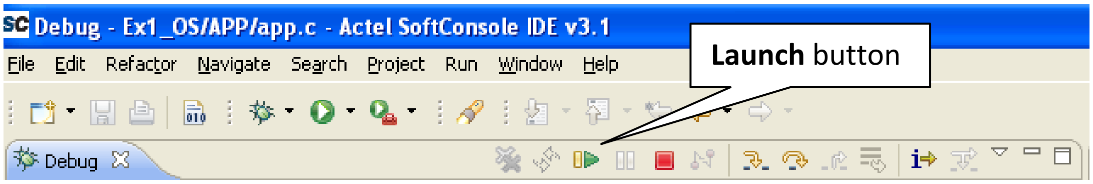
```
# Debug initialization commands for programs linked using:
#  [1] debug-in-actel-smartfusion-envm.ld

# [1] Targeting SmartFusion embedded NVM (envm) @ 0x60000000.
#    Loads at 0x60000000 but runs/debugs at 0x00000000 (i.e. ld LMA=0x60000000, VMA=0x00000000)

# Invoke debug sprite in Cortex-M3 mode
```

'Run' commands

```
cont
```

13. Via a dialog box entitled **Confirm Perspective Switch**, SoftConsole will inform you that "This kind of launch is associated with the Debug perspective." You should click the **Yes** button. You will then enter the **Debug perspective** and SoftConsole will begin downloading code to your FPGA's non-volatile memory. When all of the code has downloaded, the source file *app.c* should appear in the Debugger's editor window. The function BSP_`PreInit()` should be highlighted in this file.

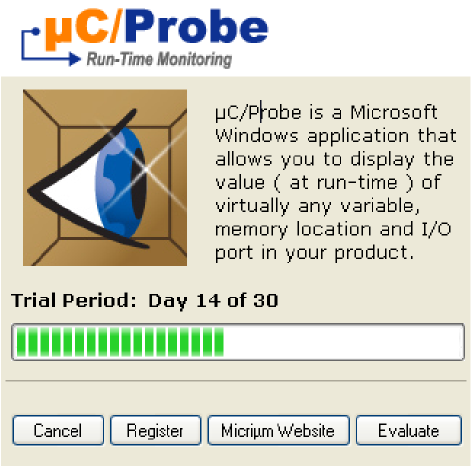
14. To begin running code, you should click the **Launch** button, as shown in the below screenshot. Your board's **D1** LED should begin blinking.


Debug - Ex1_OS/APP/app.c - Actel SoftConsole IDE v3.1
File Edit Refactor Navigate Search Project Run Window Help
Launch button
Debug

Using µC/Probe with Example 2

1. You can build and run the second example using practically the same procedure that you followed for the first. After completing the procedure for Example 2 by clicking the **Launch** button in the debugger, your board's **D1** and **D3** LEDs should begin blinking.

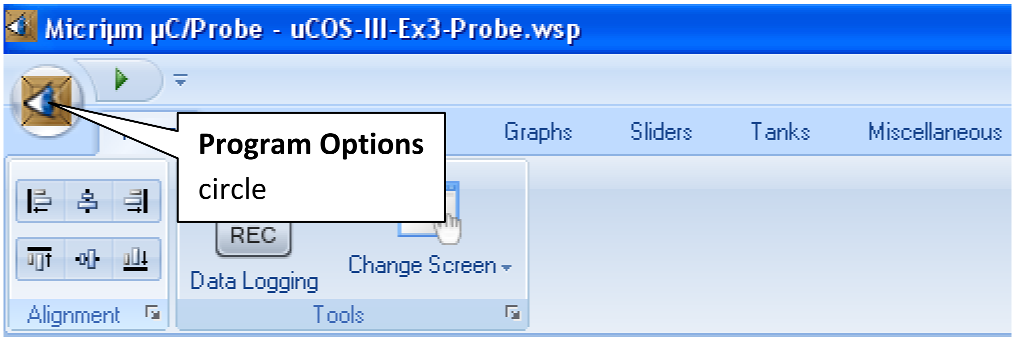
2. To start µC/Probe, you should now select **All Programs>Micriµm>uC-Probe** from your PC's **Start** menu. If you are using the 30-day evaluation version of the software, you will see a screen similar to the one shown below. You should click the **Evaluate** button.



µC/Probe is a Microsoft Windows application that allows you to display the value (at run-time) of virtually any variable, memory location and I/O port in your product.

Trial Period: Day 14 of 30

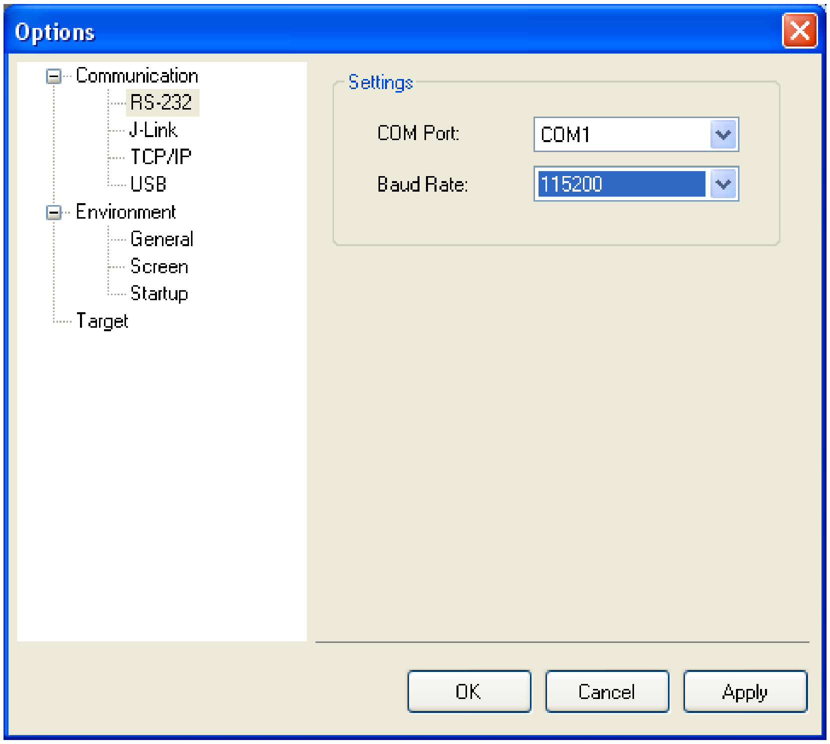
3. Within µC/Probe you should open the Workspace that is associated with the second example. You can open a workspace by clicking on the **Program Options** circle (which is shown in the below screenshot) and selecting **Open**. You'll find the Workspace for Example 2 in the following folder: *<Install folder>\MICRIUM\Software\EvalBoards\Actel\SmartFusionEvalKit\Software\SoftConsole\Ex2-OS\APP*, where *<Install folder>* is the folder to which you extracted the contents of *uCOS-III-Actel-SmartFusionEvalKit.zip*.



4. When you attempt to open the Workspace, µC/Probe should prompt you to specify a symbol file. If it does, you should specify the following file: *<Install folder>\MICRIUM\Software\EvalBoards\Actel\SmartFusionEvalKit\Software\SoftConsole\Ex2-OS\Debug\Ex2-OS.elf*. If you are not asked for the symbol file then you should right-click in the **Symbol Browser** in the lower left-hand corner of the screen and select **Add Symbols**. You should use the resulting dialog box to browse to the above file.

5. Once the symbol file has been specified, you should click on the **Program Options** circle and then click the **Options** button in the resulting menu. On the left-hand side of the **Options** dialog box that subsequently appears, you should see several different categories. You should first select **Communications**. In the **Settings** section of the **Communications** page you should choose **RS-232**. In the **Update** section, you should specify a **Wait Time** of 1 ms.

6. You should now click on the **RS-232** heading on the left side of the **Options** dialog box. On the **RS-232** page, you should select the COM port associated with your board's USB to UART interface. You should then specify a baud rate of 115200. An example **RS-232** options page, for a PC using COM1, is shown in the screenshot on the next page.



COM Port: COM1

Baud Rate: 115200

7. After specifying the **RS-232** options, you should click the **OK** button. You should then switch to µC/Probe's Run-Time view by clicking the **Start** button located in the upper left-hand corner of the main program window. µC/Probe should begin updating the components in the different data screens that comprise the workspace. You can switch between data screens using the tabs located near the top of the main program window. On the data screen labeled **Application**, you'll be able to review the results of various performance tests involving µC/OS-III. You can choose a test using the **Test Selector** dial. A brief description of each test is provided on the next page.

Test #	Description
0	Semaphore – one task signaling another task
1	Semaphore – one task signaling itself
2	Task semaphore – one task signaling another task
3	Task semaphore – one task signaling itself
4	Message queue – One task sending a message to another task
5	Message queue – One task sending a message to itself
6	Task message queue – One task sending a message to another task
7	Task message queue – One task sending a message to itself
8	Mutex – One task acquiring and releasing a mutex
9	Event flags – One task signaling another
10	Event flags – One task signaling itself

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